DEPARTMENT OF TRANSPORTATION
ENGINEERING SERVICE CENTER
Transportation Laboratory
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Sacramento, California 95819-4612

METHOD FOR EVALUATING THE CAPABILITIES OF ASPHALT CONCRETE COMPACTORS

CAUTION: Prior to handling test materials, performing equipment setups, and/or conducting this method, testers are required to read "**SAFETY AND HEALTH**" in Section G of this method. It is the responsibility of the user of this method to consult and use departmental safety and health practices and determine the applicability of regulatory limitations before any testing is performed.

A. SCOPE

This is a method to determine the ability of equipment to compact asphalt concrete.

B. TEST SECTION DESCRIPTION AND EQUIPMENT OPERATING CONDITIONS

1. All test sections are to be placed and compacted in compliance with the requirements of Section 39 of the Standard Specifications and the following conditions.

   a. The asphalt concrete shall be either Type A or Type B and have a compacted thickness of not less than 45 mm nor more than 90 mm.

   b. The test section must be at least 90 m long and one traffic lane wide. A shoulder area may be used in lieu of a traffic lane if it is at least 2.4 m wide and the length is extended to provide a surface area of at least 335 m^2.

   c. The temperature of the asphalt concrete shall be between 120 and 127°C at the beginning of breakdown rolling.

2. Compaction equipment must be operated by a qualified operator in compliance with conditions selected by the equipment manufacturer or the manufacturer's representative.

   Record the tire pressure for pneumatic compactors. Record the following conditions for vibratory compactors prior to and during testing:

   a. Vibration frequency setting
   b. Vibration amplitude setting
   c. Speed at which the compactor is being operated

3. Determine the density of the compacted asphalt concrete using a nuclear gage in the backscatter mode. Follow the applicable instructions in California Test 375.

C. DETERMINE THE COMPACTION END POINT

1. Select a test site for determining the compaction end point. This test site may be within the limits of the first test section for determining compaction capability (see Section D).

2. Instruct the compactor operator to compact the test site with repeated

passes of the compactor. Observe the compaction to confirm that the compactor is being operated with the settings noted per Section B above.

3. Measure the density at the test site after each pass of the compactor.

4. Stop the compaction when one of the following conditions occurs:

   a. The increase in density resulting from one pass of the compactor drops below 20 kg / m^3, or

   b. checking or other distress becomes apparent in the asphalt concrete being compacted.

5. Record the total number of passes applied prior to discontinuing compaction. This is designated the "compaction end point."

D. DETERMINE THE COMPACTION CAPABILITY OF THE COMPACTOR

1. Instruct the compactor operator to compact a 90 m test section in accordance with the requirements of Section B using the number of coverages necessary to achieve the "compaction end point" as determined in Section C. Each pass of the compactor should be an uninterrupted movement through the full length of the test section. (This test section may be compacted in conjunction with the testing used to determine the compaction end point.)

2. Complete the test section compaction by immediately applying one final coverage using a tandem, non-vibratory steel-tired roller having a mass not less than 7.2 tonnes.

3. Compact a second 90 m test section. Apply the same compaction procedures and conditions that were used in the first test section except that the number of coverages shall be one less than the number to reach the compaction end point.

4. Select ten test sites within each 30 m increment of each 90 m test section using a random selection procedure such as nonbiased sample cards, random numbers or the sequential random numbers from California Test 375.

5. Determine the density at each test site using a nuclear gage in the backscatter mode.

E. DETERMINE THE TEST MAXIMUM DENSITY

1. The test maximum density is the average density of five briquettes prepared and tested by the following procedures.

2. Obtain a representative sample of the asphalt concrete from the mat behind the paving machine following the sample procedure in California Test 125.

3. Prepare and compact five briquettes according to the procedures for making specific gravity test specimens in California Test 304.

4. Determine the density of each briquette according to the procedures in California Test 308, Method A.

F. CALCULATIONS AND REPORTING OF RESULTS

1. Calculate and report the density at each test site and the average of each 30 m increment to the nearest 10 kg / m^3.

2. Calculate and report the average density of the five test maximum density briquettes to the nearest 10 kg / m^3.

3. Using the average density of the briquettes, calculate the relative compaction for each test site. Obtain the average relative compaction for each 30 m increment of the two test sections to the nearest percent. Calculated fractional values of 0.5 % through 0.9%, inclusive, shall be rounded to the next higher whole number.

4. Record the test data as illustrated in Table 1 along with other pertinent data on Form TL 3113 (Figure 1).

5. The compactor is qualified for use at the evaluated conditions when *all* of the following conditions are met.

   a. The average relative compaction of each of the three 30 m increments of the 90 m test section is at least 95 %.

   b. The relative compaction at each of the 30 test sites within the test section is at least 92 %.

   c. No ridges, cracks, indentations, or other objectionable marks, or distress are evident.

6. Report the test results and qualifying operating conditions for the compactor on Form TL-310 (see Figure 2). If the compactor meets the qualifying conditions on both test sections, the approved operating conditions will be those for the section with the fewer coverages.

G. SAFETY AND HEALTH

Prior to handling, testing or disposing of any waste materials, testers are required to read: Part A (Section 5.0), Part B (Sections: 5.0, 6.0 and 10.0) and Part C (Section 1.0) of Caltrans Laboratory Safety Manual and California Test 121, Administrative Instructions for Use of Nuclear Gages. Personnel should observe the following precautions.

1. Use reasonable care, including wearing heat resistant gloves, when working with hot materials or equipment.

Users of this method do so at their own risk.

REFERENCES:
California Tests 121, 125,
304, 308 and 375

End of Text (California Test 113 contains 6 pgs.)

Table 1

CALCULATION EXAMPLES

Test Section 1 (3 coverages)

	Increment #1 Sta 68 + 50 to 68 + 80		Increment #2 Sta. 68 + 80 to 69 + 10		Increment #3 Sta. 69 + 10 to 69 + 40	
Test Site	Density, kg/m^3	RC, %	Density, kg/m^3	RC, %	Density, kg/m^3	RC, %
1	2210	96	2210	96	2240	97
2	2230	97	2230	97	2210	96
3	2210	96	2210	96	2220	96
4	2200	95	2180	94	2240	97
5	2210	96	2210	96	2220	96
6	2240	97	2230	97	2230	97
7	2210	96	2200	95	2260	98
8	2210	96	2240	97	2210	96
9	2230	97	2180	94	2230	97
10	2200	95	2210	96	2240	97
Avg. Density	2220		2210		2230	
Max. Density	2310		2310		2310	
Avg. Rel. Comp		96		96		97

Test Section 2 (2 coverages)

	Increment #1 Sta 70 + 00 to 70 + 30		Increment #2 Sta. 70 + 30 to 70 + 60		Increment #3 Sta. 70 + 60 to 70 + 90	
Test Site	Density, kg/m^3	RC, %	Density, kg/m^3	RC, %	Density, kg/m^3	RC, %
1	2200	95	2180	94	2230	97
2	2210	96	2200	95	2210	96
3	2180	94	2180	94	2200	95
4	2200	95	2200	95	2240	97
5	2180	94	2200	95	2210	96
6	2210	96	2180	94	2100	91*
7	2230	97	2210	96	2180	94
8	2200	95	2160	94	2110	91*
9	2160	94	2180	94	2230	97
10	2180	94	2150	93	2210	96
Avg. Density	2200		2180		2190	
Max. Density	2310		2310		2310	
Avg. Rel. Comp		95		94*		95

*Any one of these values would disqualify the use of only two coverages by this compactor on Caltrans Projects.

State of California • Department of Transportation
Engineering Service Center
Office of Materials Engineering and Testing Services
Form TL-3113 (Est. 9/96)

DENSITY AND RELATIVE COMPACTION TO EVALUATE COMPACTORS

DIST.	CO.	ROUTE	PM	TESTED BY:	DATE:
				Compactor	
				Model	Mass, tonne
Contract No.				Frequency: Range	Tested
AC Type	Thickness, mm			Layer Amplitude: Range	Tested
(N) Avg. Test Maximum Density				Max. Speed	No. Coverages

NUCLEAR GAGE	TEST SECTION LIMITS
Date of Last Calibration	(A) Start
Model & I.D.	(B) Finish
Standard Count (M)	(C) Length (B-A)
	(D) Width, m

FIELD NOTES AND CALCULATIONS
(Use back if more space is needed)

	RANDOM NUMBER									
(E) Left Column										
(F) Right Column										
TEST LOCATIONS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
(G) Station or Time (C × E) + A										
(H) Distance From Edge of Mat (D - 0.3) × F										
(I) Distance From Reference (℄, E. P., ETW, or Curb)										
(J) Nuclear Reading (Field Count)										
(K) Count Ratio (J/M)										
(L) Density										
Relative Compaction, % (100 L/N										

Average In-Place Density _____

Average Relative Compaction _____

FIGURE 1

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

TRANSPORTATION LABORATORY

REPORT OF TEST ON

District	County	Route	PM	Date Tested
Contractor			Manufacturer	
Model	Weight	Freq. Range	Ampl. Range	
QUALIFYING OPERATING CONDITIONS	Freq.	Amp.	Max. Speed	No. of Coverages
Remarks:				

DATE TESTED:
TESTED BY:

TL-310

FIGURE 2